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January 25, 1994

HAND CARRIED

Mr. William F. Caton
Acting Secretary
Federal Communications Commission
Washington, D.C. 20554

Re: ET Docket No. 93-62

Dear Mr. Caton:

Submitted herewith are the original and four copies of the comments of Jules Cohen & Associates, P.C., responding to the Notice of Proposed Rule Making in the Matter of Guidelines for Evaluating the Environmental Effects of Radiofrequency Radiation, ET Docket No. 93-62.

Respectfully submitted,

JULES COHEN & ASSOCIATES, P.C.

By: Jules Cohen
Jules Cohen

Enclosures

cc: Dr. Robert F. Cleveland (with enclosure)

ORIGINAL

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of

Guidelines for Evaluating	)	
Environmental Effects of	)	ET Docket No. 93-62
Radiofrequency Radiation	)	

COMMENTS OF
JULES COHEN & ASSOCIATES, P.C.
FCC NOTICE OF PROPOSED RULE MAKING

INTRODUCTION

Jules Cohen & Associates, P.C., Consulting Electronics Engineers, (JC&A) is the successor to firms that, since 1952, have provided consulting engineering services to the telecommunications industry in general, and particularly to broadcasters. During approximately the past twenty years, the firm has been involved in the formulation of nonionizing radiation standards and in both the theoretical calculations and measurements of fields for determination of compliance with such standards.

JC&A supports the Commission's proposal to use the new standard for RF exposure approved by the Institute of Electrical and Electronic Engineers (IEEE) September 26, 1991, and adopted by the American National Standards Institute (ANSI) November 18, 1992, identified as ANSI/IEEE C95.1-1992, for evaluating the environmental effects of the emitters that the Commission authorizes. Those standards are, in some respects, more stringent than the 1982 standard now used by the Commission for evaluating environmental effects and, in addition, impose new limitations, particularly in the matter of induced and contact currents. The more stringent requirements and the need for evaluating the magnitude of body currents at frequencies below 100 MHz add to the burden of compliance, particularly for broadcasters who, in general, operate the highest power emitters to which workers and the public are likely to be exposed.

The greater burden imposed can be mitigated by procedures that permit efficient prediction of exposure fields and the recognition that induced current measurements are not necessary when electric field strength is below a threshold determinable by reference to both measurements and predictive methods described in the scientific literature. The Commission can further aid in easing the matter of showing compliance with its environmental rules by providing its interpretation of aspects of the standard which may not be clear to a lay person. That clarification may be most appropriately incorporated in a revision of OST Bulletin No. 65 making it consistent with the newer standard..

Of importance also is the need to recognize that ANSI/IEEE C95.1-1992 is a "living document" subject to refinement and revision. Subcommittee IV of IEEE Standards Coordinating Committee 28, the subcommittee charged with responsibility for writing and updating the standard, meets on a regular basis to discuss desirable clarifications or revisions. If changes proposed are approved by the entire subcommittee, the changes are submitted to the parent committee for its approval (or disapproval). Both IEEE and ANSI procedures provide for making changes without the requirement to follow the entire process for standards approval so long as the changes do not make basic modifications in essential elements of the standard. It is understood that the type of change described here is recognized by issuance of a supplement to the standard until, in a new printing, the modifications can be incorporated in the body of the standard. The Commission is urged to recognize and accept such changes without the necessity of a formal rule making. The Commission should employ the most recent edition of ANSI/IEEE C95.1-1992 with whatever supplements are appropriate.

In following sections, JC&A responds to the specific matters raised by the Commission.

DEFINITION OF "CONTROLLED" AND "UNCONTROLLED" ENVIRONMENT

The most significant portions of the ANSI/IEEE standard defining "controlled" and "uncontrolled" environments are as follows:

> Controlled environments are locations where there is exposure that may be incurred by persons aware of the potential for exposure as a concomitant of employment, by other cognizant persons, or as the incidental result of transient passage...
>
> Uncontrolled environments are locations where there is the exposure of individuals who have no knowledge or control of their exposure. The exposures may occur in living quarters or workplaces...

The interiors of buildings devoted exclusively to the housing of broadcast transmitters, where access is permitted only to persons concerned with operation and maintenance of those transmitters, clearly fall into the controlled category. Similarly, the immediate vicinity of a transmitting antenna, with at least posting warning of the presence of radiofrequency energy, is also a controlled environment complying with the criterion of "other cognizant persons." Nearby areas, where only "transient passage" of persons is to be expected likewise justify a controlled environment classification. Additionally, transmitter sites located in relatively inaccessible areas may be considered to be within controlled environments so long as they are posted.

Without question, however, homes, their adjacent yards, streets where children may be at play, schools, schoolyards, hospitals, nursing homes, play fields, picnic areas, and other locations where people may live or gather for hours at a time require an uncontrolled environment category.

An instance where the uncontrolled environment classification should be applied in the workplace is in offices and studios. In such places, neither employees nor visitors to the facilities would have an expectation of exposure to relatively high levels of radiofrequency energy and the lower maximum permissible exposures (MPEs) of the uncontrolled environment standard should apply.

Portable transmitters are used widely, particularly for news gathering. The operators of those transmitters are persons exposed to radiofrequency fields "as a concomitant of employment" and controlled environment criteria apply. Persons nearby, not employed in the operation, require protection on an uncontrolled environment basis; however, in consideration of

the low power used in portable devices, such as hand-held transceivers, exposure of the public to levels in excess of uncontrolled environment MPEs is highly unlikely. Licensees should provide guidance to employees engaged in transmissions from remote locations as to the need, if it exists, to maintain appropriate spacing from the transmitting devices to nearby persons.

LOW POWER DEVICES/EXCLUSIONS

In paragraph 18 of the Notice, the Commission proposes:

> For purposes of the exclusions that are based on radiated power, we propose to exclude only those low-power devices that meet the uncontrolled guidelines. However, the exclusions based on SAR [Specific Absorption Rate] could apply according to the actual situation or "environment" in which a device is used.

The foregoing proposal has an inherent inconsistency. The radiated power criterion of the standard recognizes that sufficiently low radiated power satisfies the SAR criterion on which the standard is based. Therefore, whether compliance of the device with the standard is based on radiated power or SAR, the same controlled/uncontrolled considerations apply.

Based on discussions in IEEE Subcommittee IV, radiated power is expected to be defined as "power radiated into space in the absence of nearby objects." Whether a manufacturer proposes exclusion based on either radiated power or SAR, the authorization process should contain a requirement that the specifications for the device include maximum rated radiated power and/or SAR in the body of the user when employed in a prescribed manner. The manufacturer should describe the procedure followed in determining either radiated power or SAR, including a description of the antenna range or laboratory and the qualifications of the personnel conducting the tests.

Devices now in use under the 1982 ANSI standard should be allowed to be continued in use for their normal lifetime. No expectation exists that currently used low-power devices constitute a risk to the user even if future restrictions are to be more stringent. Furthermore, the sale of presently available stocks and devices that might be manufactured for a year after adoption

of the change in Commission standards should be allowed to be judged on the basis of the 1982 standard. Within one year, manufacturers should be required to submit new requests for authorization based on the 1992 standards and, after one year, devices should include a certification of compliance with the low-power exclusion clause based on either radiated power or SAR.

EXISTING CATEGORICAL EXCLUSIONS

Continued categorical exclusion of most facilities authorized under Part 74 of the Commission's Rules is justified. Present exclusions include: remote pickup and low power auxiliaries; aural broadcast studio-transmitter links, inter-city relays and microwave booster stations; television broadcast auxiliary stations; low power auxiliary stations; and low-power FM broadcast translator and FM booster stations.

Devices falling in the category of remote pickup or low power auxiliaries are hand held, vehicle mounted, or base stations utilizing antennas which are either roof mounted or tower mounted. The hand-held devices would be expected to comply with the exclusion for low-power devices and therefore merit categorical exclusion. Vehicle-mounted devices usually operate at powers of 30 watts or less, but can use power as high as 100 watts. At 30 watts, the uncontrolled environment radius is approximately 1.3 meters and exposure within this distance for thirty minutes is highly unlikely, particularly in consideration of the fact that transmissions are normally intermittent. Consequently, vehicle-mounted transmitters of 30 watts or less also merit categorical exclusion. With transmitter power as high as 100 watts, the uncontrolled environment criterion in the most critical part of the spectrum (30 to 300 MHz) is met only beyond 2.6 meters. Since extended exposure within this distance is possible, the licensee should be required to adopt procedures assuring that the exposure criteria are met. Hence, categorical exclusion may not be justified.

Continued categorical exclusion for base stations is justified. In consideration of the universal use of vertical polarization, and considering even the simplest of antennas, a vertical dipole, a 100-watt base station will not exceed the MPE for either the controlled or uncontrolled

environment if the lowest element of the antenna is at least three meters above the rooftop. As with the lowest power devices, no work should be done on the antenna, or in its immediate proximity, while the antenna is energized.

Aural broadcast studio-transmitter links (STL), inter-city relays, and microwave boosters all merit continued categorical exclusion. All of these devices require line of sight for satisfactory operation and use high gain antennas that concentrate radiated energy toward the receiving point. For instance, an STL operating at 942 MHz and utilizing the smallest of the antennas employed for the service has a maximum relative field of only 23 percent at angles of 30 to 90 degrees from the beam axis. Assuming as much as 10 watts into the antenna (a high power not generally achieved) the uncontrolled environment MPE of 0.63 mW/cm^2 is reached only within 52 centimeters of the antenna.

Television broadcast auxiliaries including TV pickup, TV STL, TV relay, TV translator relay and TV microwave boosters all merit continued categorical exclusion. Like the aural broadcast STLs, all the TV broadcast auxiliaries, with one exception, require line of sight. Fresnel zone clearance is required also for reliable operation. With no transmitters operating with power in excess of 20 watts, and with the high-gain, narrow-beamwidth antennas required to achieve suitable signal-to-noise ratios and fade margins at the receive point, the potential for exposure in excess of the uncontrolled environment MPE is negligibly small.

The exceptions to the line of sight requirement are the TV remote pickup systems that rely upon receiving systems that can extract usable information from very weak signals coming from any direction or polarization. These systems, operated in the 2 GHz band, use signals reflected off buildings to reach points outside the line of sight. The maximum input to the antenna would be in the order of eight watts. The maximum near field power density would be 0.91 mW/cm^2 based on use of a six-foot diameter parabolic antenna. The MPE is 1.3 mW/cm^2 for the uncontrolled environment. Beyond the near field, which extends only 5.6 meters, the power density is even less. Therefore, even this use of a TV pickup, which relies on "bouncing" the signal off nearby buildings merits categorical exclusion.

Low power auxiliaries limited to power output of 50 milliwatts in the VHF TV band, 250 milliwatts in the UHF TV band and one watt in other parts of the spectrum all merit exclusion under the low-power exclusion rule except for body-mounted wireless microphones. As to the microphones concealed in the costume of the performer, exclusion will have to be based upon SAR considerations. Such exclusion is expected to occur. Categorical exclusion of low power auxiliaries is certainly warranted with the provision that wireless microphones intended to be worn on the body must be shown to comply with the standard based on SAR.

FM broadcast translator stations and FM broadcast booster stations should continue to be categorically excluded if the effective radiated power (ERP) is 100 watts or less. The uncontrolled environment MPE in the 1992 standard is 0.2 mW/cm^2 for the 88 to 108 MHz band in which these facilities operate. In the main beam of radiation for a 100-watt ERP, horizontally polarized, power density exceeds 0.2 mW/cm^2 only within 4.1 meters. If circular polarization is used, the distance becomes 5.8 meters. Even the greater distance (19 feet in English units) is such that no FM broadcast translator or booster station would be expected to operate at such a low level, or so located that the main beam of radiation could be intercepted at such a short distance.

INDUCED AND CONTACT RF CURRENTS

With respect to the new requirement of the 1992 ANSI/IEEE guidelines regarding the maximum exposure to induced and contact RF currents from 3 kHz to 100 MHz, the Commission proposal in paragraph 22 of the Notice appears to be reasonable, *i.e.*, at multiple use sites all FM broadcast stations regardless of frequency should be considered. However, at many multiple use sites as well as at single station sites the ground level electric field is quite low relative to the MPEs. At such sites, induced current measurements should not be required. References 1 through 4 provide a basis for establishing thresholds of electric field strength below which induced currents will not exceed the MPEs of the standard. Incorporation of such thresholds in a revised OST Bulletin No. 65 would be appropriate.

Contact currents depend, not only on the ambient electric field and the grounding of the person, but also on the size, shape and orientation of the object being contacted. As more data

are collected on contact currents under a range of conditions, perhaps guidelines can be adopted suggesting the circumstances not requiring contact current measurements. Meanwhile, judgments will have to be made on a case-by-case basis relative to the need for contact currents.

With respect to currents induced in tower climbers, references 5 and 6 are useful. They permit a determination of what circumstances permit a worker to climb an energized tower without exceeding MPE limits.

ALTERNATIVE RF EXPOSURE GUIDELINES

Although the Commission states its belief (concurred in by JC&A) that ANSI/IEEE C95.1-1992 "will provide the Commission with better scientifically-based criteria for use in evaluating human exposure to RF radiation, and ensure that FCC-regulated facilities comply with the latest safety standards for RF exposure" (¶23), it nonetheless requests comments as to whether other standards such as those promulgated by the National Council on Radiation Protection and Measurements (NCRP) or the International Radiation Protection Association (IRPA) may be used instead. The Commission notes that, whereas the ANSI/IEEE MPE for the uncontrolled environment ranges from 2 mW/cm^2 at 3 GHz increasing to a maximum of 10 mW/cm^2 at 15 GHz to 300 GHz, NCRP specifies a fixed level of 1 mW/cm^2 for exposure of the general public in the frequency range of 1.5 to 300 GHz.[1] Furthermore, IRPA specifies a similar exposure limit over the range from 2 GHz to 300 GHz.

Actually, the differential between the NCRP/IRPA and ANSI/IEEE protection guides is not determinable without consideration also of averaging time. NCRP/IRPA allow averaging over a 30 minute period for the general population. On the other hand, in recognition of the fact that, at higher frequencies, the applicable consideration is skin burning, ANSI/IEEE limits the averaging time above 3 GHZ. At 15 GHz, the averaging time is 6 minutes, at 100 GHz, the averaging time is 37 seconds, and at 300 GHz, the averaging time is only 10 seconds. The result

[1] This frequency is in error. The NCRP standard does not extend beyond 100 GHz.

is that, over most of the applicable range, the energy absorption allowed by ANSI/IEEE is far less than that allowed by NCRP/IRPA.

Another difference noted is that NCRP requires use of the general population criterion even for the workplace if the exposure is to carrier frequencies modulated at a depth of 50 percent or greater at frequencies between 3 and 100 Hz. This is a requirement that has no practical application. Broadcast transmitters are not modulated at these frequencies at a depth of 50 percent or greater except for very short intervals. Consequently, the circumstances do not arise that would trigger the requirement to use the stricter standard in a controlled environment.

A further reason for favoring ANSI/IEEE over NCRP/IRPA is the process used in the development. Only ANSI/IEEE is an open process permitting the participation of anyone who might make a contribution to the effort. The subcommittee that developed the standard had about 125 people, with approximately 30 percent from universities, 28 percent from government, approximately 10 percent from industry, 12 percent from the military, and the remainder from nonprofit organizations, consultants and the general public. Persons involved in research constituted approximately 72 percent of the total. Participation in NCRP and IRPA are by invitation only. Of interest to note is that 9 of the 16 people shown by NCRP to have participated in development of its standard, were active also in the development of the ANSI/IEEE standard.

EFFECTIVE DATE AND OTHER ISSUES

Demonstration of compliance with the new standard should be required for all applications for new facilities, changed facilities and license renewals 60 days after the effective date of the change in order to avoid the need to rework applications in process. Furthermore, as in the case of the present standard, the effective date should be set after the development of a revised edition of OST Bulletin No. 65 so that adequate guidance is available for applicants.

With respect to equipment in use, no resubmission of requests for authorizations should be required. However, as indicated above, within one year, manufacturers should provide exposure data for all new equipment.

For all applications, the Commission should require a brief statement providing the reasoning behind a conclusion that the proposed operation is consistent with the environmental standards. That statement need not go into great detail, but the methodology employed and the qualifications of the person making the determination should be provided.

MEASUREMENT PROCEDURES AND RELATED ISSUES

The use of ANSI/IEEE C95.3-1992, "Recommended Practices for the Measurement of Potentially Hazardous Electromagnetic Fields" as guidance for the making of measurements is appropriate. Like C95.1-1992, the measurement document is also subject to revision and the latest edition should be employed. C95.3 has useful information relative to measurement equipment together with warnings about the appropriate instrumentation for different circumstances.

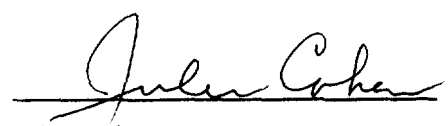
Although major manufacturers of measuring equipment are now offering induced current meters, little experience is available for their evaluation. It is expected that adoption of the 1992 ANSI/IEEE standard will spur the manufacturers to increase their efforts and provide documentation as to the accuracy and reliability of their products.

Protective clothing appears to offer considerable help in complying with protection standards in instances where work in the vicinity of energized antennas is imperative. A recently introduced material consisting of polyester and stainless steel threads in a cotton wrap has been tested extensively and endorsed by the Occupational Safety and Health Administration (OSHA) as providing compliance with ANSI at power densities of 20 mW/cm^2 for frequencies to 60 MHz and at power densities of 125 mW/cm^2 for frequencies from 65 MHz to 10 GHz. In addition, the study sponsored by the Commission has shown that some work gloves used by tower climbers can be beneficial in reducing body currents.

CONCLUSION

JC&A commends the Commission in its initiative to incorporate the latest standard for conforming to the dictates of the National Environmental Policy Act. JC&A stands ready to assist the staff in any way that would be useful. Of particular interest would be the updating of OST Bulletin No. 65.

Respectfully submitted,
JULES COHEN & ASSOCIATES, P.C.



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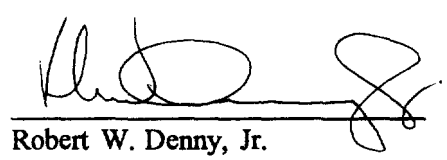

Robert W. Denny, Jr.
President

January 25, 1994

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